

# Ecomorphology of the axial skeleton in Odontocetes and Mysticetes

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## Introduction

Although all cetaceans possess a streamlined body, their phenotypes vary widely among species according to their different lifestyle. The aim of this research is to **establish relationships between characteristics of the vertebral column of different cetaceans and their ecology.**

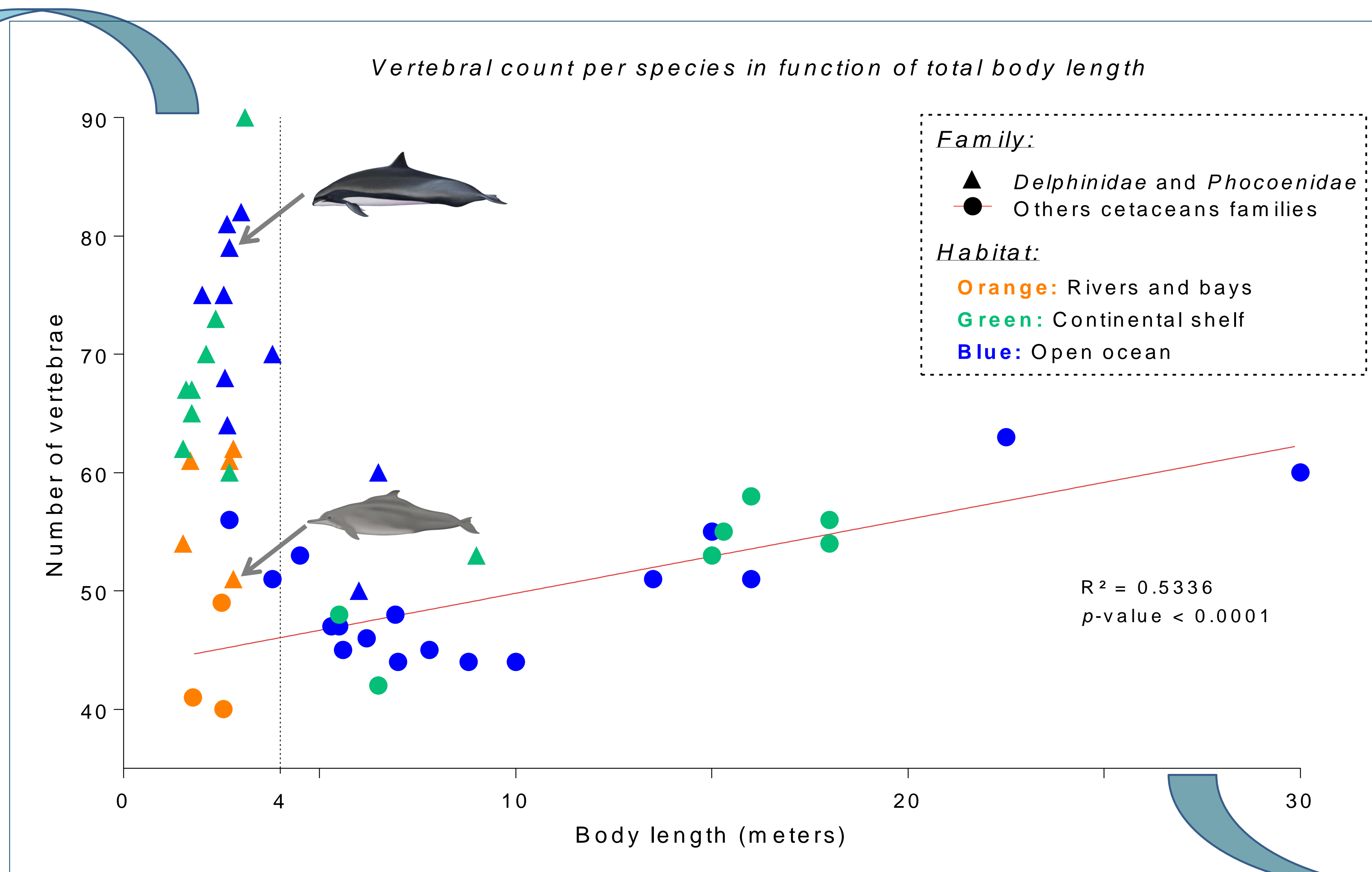
## Material and methods

The vertebral count (*i.e.* the total number of vertebrae) of **51 cetaceans species** was taken on skeletons available in eight different museums in the world. The maximal length, height and width of the vertebral centrum of each vertebra was also measured with digital callipers.

## Results and discussion

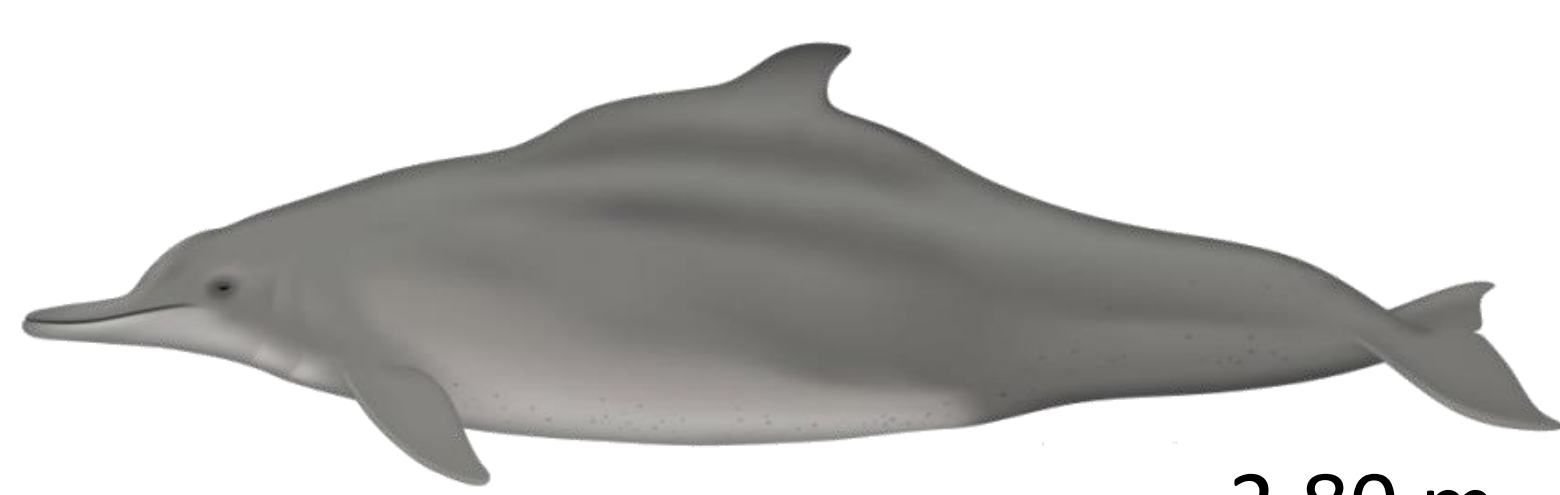
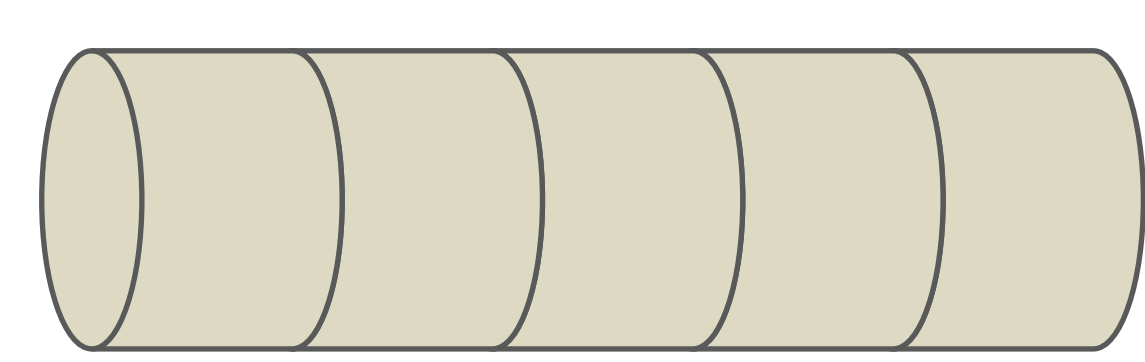

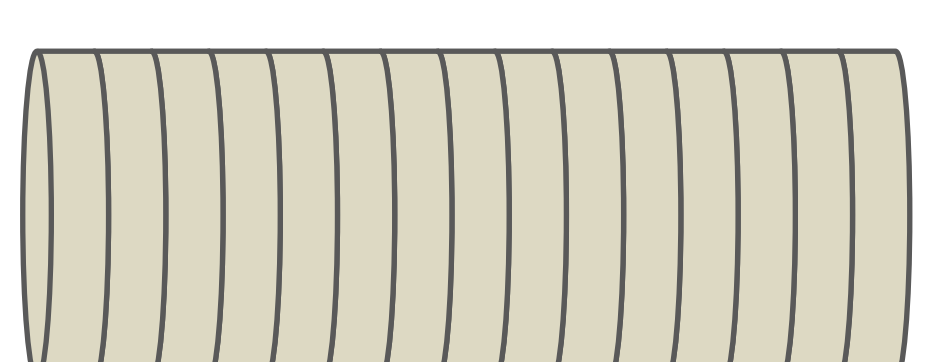
All cetaceans species living in shallow waters (rivers, estuaries and bays) are small (<4m) and have a low vertebral count. Species living in deeper waters (continental shelf and open ocean) possess either a larger body length or a higher vertebral count. There are no cetacean species having a high vertebral count.

The variability of vertebral count is higher for species with a **body length inferior to four meters**. Most of this variability is due to two different families of Odontocetes: **Delphinidae and Phocoenidae** (▲). These families **possess a higher vertebral count** (50 to 90 vertebrae) compared to other families (40 to 65 vertebrae).



There is a linear relationship between body length and vertebral count for **families with low vertebral count** (●) (*i.e.* all families except *Delphinidae* and *Phocoenidae*). **Larger species have a slightly higher number of vertebrae** than smaller species but it never exceeds 65 vertebrae.

There is no relationship between the vertebral count and body length for *Delphinidae* and *Phocoenidae* (▲). But species living further away from the shoreline possess a higher number of vertebra than more coastal species. This means that vertebrae are shorter for open ocean species having a high vertebral count. It results in a **stiffer vertebral column in fast swimming open ocean species than in riverine and coastal species.**

<p>Humpback dolphin (<i>Sousa plumbea</i>)</p>  <p>2.80 m</p> <p>51 vertebrae</p>  <p>Longer vertebral centrams More flexible vertebral column Good maneuverers</p>	<p>Fraser's dolphin (<i>Lagenodelphis hosei</i>)</p>  <p>2.70 m</p> <p>79 vertebrae</p>  <p>Shorter vertebral centrams Stiffer vertebral column Efficient fast swimmers</p>
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## Conclusion

All species living in **shallow waters** are small and have a low vertebral count with proportionally longer vertebral bodies. It results in a very **flexible body** adapted for manoeuvres in complex environments.

Species living in **open ocean** have two distinct morphologies:

- An **extremely large body** with low vertebral count allowing to cover long distances.
- A small body with **high vertebral count** resulting in a stiffer body allowing accelerations in open sea.

## Aknowledgements

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